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IN THE UNITED STATES PATENTS AND TRADEMARK OFFICE

K-2006

Applicant : Hiromitsu Seto et al.
Title : GLASS COMPOSITION
Serial No. : 09/964,506
Filed : September 28, 2001
Group Art Unit : 1755
Examiner : Elizabeth A. Bolden

Hon. Commissioner for Patents
P.O. Box 1450, Alexandria, VA 22313-1450

March 12, 2004

APPEAL BRIEF

Sir:

Further to the Notice of Appeal filed on February 2, 2004, an Appeal Brief is submitted in triplicate. A check in the amount of \$330.00 is attached herewith for the appeal brief fee.

REAL PARTY IN INTEREST

The applicant is the real party in interest.

RELATED APPEALS AND INTERFERENCES

There is no related appeal and interference.

STATUS OF CLAIMS

Claims 1-9 and 12 are pending in the application, and were rejected finally. Claims 10, 11, 13 and 14 were cancelled. Claims 1-9 and 12 are at issue.

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STATUS OF AMENDMENT

In the final Action of August 22, 2003, claims 1-14 were rejected by the cited references. In response to the final Action, claims 1, 3-6 and 12 were amended, and claims 10, 11, 13 and 14 were cancelled.

In response to the amendment, in paragraph 7 of the advisory Action, it was held that the 35 U.S.C. 102(b) rejection over Boulos et al. '845, Nagashima et al. '122, Sakaguchi et al. '846 and Nagashima et al. '896 and the 35 U.S.C. 103(a) rejection over Cheng et al. '778 in view of Boulos et al. '845 as applied in the first Office Action on the merits have not been overcome as amended. Also, it was held in paragraph 7 of the advisory Action, for the purpose of appeal, the proposed amendment will be entered and claims 1-9 were rejected.

In the application, claim 12, which was rejected in the first Action, is still pending in the application. It is assumed that claim 12 was missing in paragraph 7 of the advisory Action. Please correct this matter.

SUMMARY OF INVENTION

The present invention relates a glass composition suitable for a vehicle, which can be effectively strengthened by air-blast cooling.

In a conventional float glass plate employed in a vehicle, the thickness is generally from 3.5 to 4.8 mm. The conventional flat glass plate can be strengthened by the air-blast cooling. However, recently, in order to improve fuel consumption of the vehicle, the thickness of the glass plate of the vehicle is required to be decreased as thin as possible. However, as the thickness of the glass plate is reduced, the heat capacity of the glass plate is reduced, as well, so that the surface compressive stress decreases. Consequently, the glass plate can not be sufficiently strengthened

by the air-blast cooling, as explained in paragraph 0008 of the specification.

Conventionally, it is considered that a thin glass plate with the thickness less than 3.1 mm can not be strengthened by air-blast cooling. However, the glass plate of the invention can be strengthened by the air-blast cooling. Accordingly, the glass composition of the invention can provide a strengthened glass plate with the thickness less than 3.1 mm, which was generally considered impossible.

For the glass plate with the thickness more than 3.1 mm, the glass plate can have the same surface compression stress as that of the conventional glass plate with energy less than that used conventionally, thereby reducing the cost for strengthening.

In the invention, it was found that in case a specific combination of the glass compositions used in a conventional soda-lime-silica glass is selected, the glass composition can be strengthened easily. Although the property is improved, the glass of the invention can be formed in a float process and durability of the glass is excellent.

As recited in claim 1, a glass composition of the invention comprises 65 wt.% to less than 74 wt.% SiO_2 ; 0-5 wt.% B_2O_3 ; 0.1-2.5 wt.% Al_2O_3 ; 0.4 to less than 2 wt.% MgO ; 5-15 wt.% CaO ; 0-10 wt.% SrO ; 0-10 wt.% BaO ; 0-5 wt.% Li_2O ; 10-18 wt.% Na_2O ; 0-5 wt.% K_2O ; and 0-0.40 wt.% TiO_2 . A total amount of Li_2O , Na_2O and K_2O is 10-20 wt.%.

In the invention, a total amount of MgO , CaO , SrO and BaO is greater than 10 wt.% to 15 wt.%, and MgO is less than 2 wt%. In the invention, since the specific combination of MgO and the total amount of MgO , CaO , SrO and BaO are used, the thermal stress coefficient is increased and the reinforcing capability is improved, i.e. glass composition can be strengthened easily, as explained in paragraph 0034 of the specification.

Also, in the invention, a product of a mean linear expansion coefficient in a range of 50-350°C and Young's modulus is 0.71-0.90 MPa/°C, and a mean linear expansion coefficient in a range of 50-350°C is 80×10^{-7} - 110×10^{-7} /°C.

Generally, it is known that as the linear expansion coefficient becomes greater, Young's modulus becomes smaller. Therefore, it is not easy to increase both linear expansion coefficient and Young's modulus. In the glass composition of the invention, both linear expansion coefficient and Young's modulus can be increased.

In particular, a conventional soda-lime-silica glass has a linear expansion coefficient of 85-90 $\times 10^{-7}$ /°C and Young's Modulus of 71.6 GPa (7300 kg/mm²). Thus, the product of the linear expansion coefficient and Young's modulus is 0.61 to 0.64 MPa/°C. This value is less than the value of 0.71-0.90 MPa/°C as recited in claim 1. This means that the glass of the invention in the specific ranges as recited in claim 1 can be strengthened easily as compared with the conventional soda-lime-silica glass, as explained in paragraph 0051 of the specification.

Namely, in the conventional soda-lime-silica glass, the product of the linear expansion coefficient and Young's modulus is less than that of the present invention. Although the glass compositions of the invention are generally included in the range of the conventional soda-lime-silica glass, the glass composition of the invention can be strengthened easily by the air-blast cooling.

ISSUE

(1) Whether claims 1-7, 9 and 12 are anticipated under 35 U.S.C. 102(b) by Boulos et al.

(2) Whether claims 1-9 and 12 are anticipated under 35 U.S.C. 102(b) by Nagashima et al. '122.

(3) Whether claims 1-9 and 12 are anticipated under 35 U.S.C. 102(b) by Sakaguchi et al.

(4) Whether claims 1-9 and 12 are anticipated under 35 U.S.C. 102(b) by Nagashima et al. '896.

(5) Whether claims 1-4, 6, 7 and 12 are unpatentable under 35 U.S.C. 103(a) over Cheng et al. in view of Boulos.

GROUPING OF CLAIMS

In each group, claim 1 represents the invention.

ARGUMENT

(1) Whether claims 1-7, 9 and 12 are anticipated under 35 U.S.C. 102(b) by Boulos et al.

In Boulos et al., a glass comprises 68-75 wt.% of SiO_2 , 0-5 wt.% of Al_2O_3 , 5-15 wt.% of CaO , 0-10 wt.% of MgO , 10-18 wt.% Na_2O and 0-5 wt.% K_2O . Also, by adding some amounts of Fe_2O_3 ($\text{Fe}^{2+}/\text{Fe}^{3+}$), MnO_2 , TiO_2 , CeO_2 , V_2O_5 , and Cr_2O_3 to the above glass, a glass with green color having excellent ultraviolet absorbing ability can be obtained.

In the present invention, it was found that in the very limited range of the conventional soda-lime-silica glass, the glass can be strengthened easily and manufactured with a float system. Especially, in the present invention, since the glass compositions are limited, i.e. the specific combination and amounts of SiO_2 , MgO and the total amount of MgO , CaO , SrO and BaO , the linear expansion coefficient and Young's modulus are improved. As a result, the glass can be strengthened easily. Boulos et al. does not disclose or suggest the specific linear expansion coefficient and Young's modulus of the present invention.

Boulos et al. shows the regular soda-lime-silica glass, and does not disclose the specific combination of the glass components and the advantages of the invention. The linear expansion

coefficient and Young's modulus are not considered at all in Boulos et al. Therefore, Boulos et al. does not disclose claim 1 of the invention.

(2) Whether claims 1-9 and 12 are anticipated under 35 U.S.C. 102(b) by Nagashima et al. '122.

In Nagashima et al. '122, a glass comprises 65-80 wt.% of SiO_2 , 0-5 wt.% of Al_2O_3 , 5-15 wt.% of CaO , 0-10 wt.% of MgO , 10-18 wt.% Na_2O , 0-5 wt.% K_2O , 0-5 wt.% B_2O_3 , and 0.07-0.18 wt.% SO_3 , wherein $\text{MgO} + \text{CaO}$ is 5-15 wt.% and $\text{Na}_2\text{O} + \text{K}_2\text{O}$ is 10-20 wt.%. In this invention, the ratio of the amounts of Fe_2O_3 , TiO_2 and CeO_2 with respect to the amount of FeO is specified, so that a green glass composition with ultraviolet and infrared ray absorption ability is obtained.

A glass composition of the invention comprises 65 wt.% to less than 74 wt.% SiO_2 ; 0-5 wt.% B_2O_3 ; 0.1-2.5 wt.% Al_2O_3 ; 0.4 to less than 2 wt.% MgO ; 5-15 wt.% CaO ; 0-10 wt.% SrO ; 0-10 wt.% BaO ; 0-5 wt.% Li_2O ; 10-18 wt.% Na_2O ; 0-5 wt.% K_2O ; and 0-0.40 wt.% TiO_2 . A total amount of Li_2O , Na_2O and K_2O is 10-20 wt.%. When the essential components of the invention are compared with those of Nagashima et al. '122, Nagashima et al. '122 includes 0.07-0.18 wt.% SO_3 , not included in the invention. In regard to other components, the present invention includes components, not specified in Nagashima et al. '122.

Further, the linear expansion coefficient and Young's modulus as specified in the present invention are not disclosed or suggested in Nagashima et al. '122. Therefore, Nagashima et al. '122 does not disclose claim 1 of the invention.

(3) Whether claims 1-9 and 12 are anticipated under 35 U.S.C. 102(b) by Sakaguchi et al.

In Sakaguchi et al., a glass comprises 65-80 wt.% of SiO_2 , 0-5 wt.% of Al_2O_3 , 0-10 wt.% of MgO , 5-15 wt.% of CaO , 10-18 wt.% Na_2O , 0-5 wt.% K_2O , and 0-5 wt.% B_2O_3 , wherein $\text{MgO} + \text{CaO}$ is 5-15 wt.% and $\text{Na}_2\text{O} + \text{K}_2\text{O}$ is 10-20 wt%. Also, specific amounts of Fe_2O_3 ($\text{FeO}/\text{T-Fe}_2\text{O}_3$), TiO_2 , CeO_2 , CoO and Se are used, so that colored glass with excellent ultraviolet and infrared ray absorption ability is obtained.

In Sakaguchi et al., the components used in the invention are generally disclosed. However, MgO and Al_2O_3 used in the invention as the essential components are not used as the essential components in Sakaguchi et al. Further, the linear expansion coefficient and Young's modulus as specified in the present invention are not disclosed or suggested in Sakaguchi et al. Thus, Sakaguchi et al. simply discloses the general soda-lime-silica glass, and does not disclose the present invention.

(4) Whether claims 1-9 and 12 are anticipated under 35 U.S.C. 102(b) by Nagashima et al. '896.

In Nagashima et al. '896, a glass comprises 65-80 wt.% of SiO_2 , 0-5 wt.% of Al_2O_3 , 5-15 wt.% of CaO , 0-10 wt.% of MgO , 10-18 wt.% of Na_2O , 0-5 wt.% of K_2O , and 0-5 wt.% of B_2O_3 , wherein $\text{MgO} + \text{CaO}$ is 5-15 wt.% and $\text{Na}_2\text{O} + \text{K}_2\text{O}$ is 10-20 wt%. By defining a ratio of amounts of Fe_2O_3 , TiO_2 , CeO_2 and La_2O_3 with respect to FeO , a green glass composition with excellent ultraviolet and infrared ray absorption ability is obtained.

In Nagashima et al. '896, the components used in the invention are generally disclosed. However, MgO and Al_2O_3 used in the invention as the essential components are not used as the essential components in Nagashima et al. '896. Further, the linear expansion coefficient and Young's modulus as specified in the present invention are not disclosed or suggested in Nagashima et al. '896.

Nagashima et al. '896 simply discloses the general soda-lime-silica glass, and does not disclose the present invention.

(5) Whether claims 1-4, 6, 7 and 12 are unpatentable under 35 U.S.C. 103(a) over Cheng et al. in view of Boulos et al.

In Cheng et al., a high total iron containing soda-lime-silica glass batch includes typical soda-lime-silica glass batch ingredients, an ultraviolet radiation absorbing quantity of a cerium containing compound, a high amount of total iron, and a small amount of carbon.

Although the soda-lime-silica glass is disclosed in Cheng et al., the specific amounts of the glass components used in the invention are not specified. Further, the linear expansion coefficient and Young's modulus as specified in the present invention are not disclosed or suggested in Cheng et al. Cheng et al. simply discloses the general soda-lime-silica glass, and does not disclose the present invention.

As explained before, Boulos et al. discloses the regular soda-lime-silica glass, and does not disclose the specific combination of the glass components and the advantages of the invention. Also, Cheng et al. and Boulos et al. do not disclose or suggest the linear expansion coefficient and Young's modulus. Although the soda-lime-silica glass is disclosed in the cited references, the present invention is not disclosed or suggested in Cheng et al. and Boulos et al.

In sum, in the cited references, the color compositions are added to the conventional soda-lime-silica glasses which can be manufactured with a regular float system, so that the glasses have specific properties. In the present invention, it was found that in the very limited range of the conventional soda-lime-silica glass, the glass can be strengthened easily and manufactured with a

float system. The cited references do not disclose or suggest the present invention. Namely, the linear expansion coefficient and Young's modulus are improved by the specific combination and amounts of SiO_2 , MgO and the total amount of MgO , CaO , SrO and BaO . As a result, the glass can be strengthened easily.

The cited references show the regular soda-lime silica glass, and do not disclose the specific combination and the advantages of the invention. The linear expansion coefficient and Young's modulus are not considered at all in the cited references. Therefore, the features of the invention are not disclosed or suggested in the cited references.

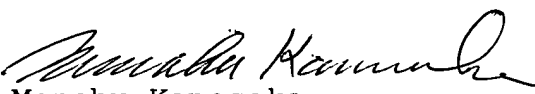
CONCLUSION

As explained above, the cited references do not disclose the features of the invention. Even if the cited references are combined, the specific features as recited in the claims of the invention are not obvious from the cited references. Claims of the invention are patentable over the cited reference.

It is respectfully requested that the rejections be reversed, and the application be allowed.

Respectfully Submitted,

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CLAIMS

1. A glass composition comprising:

65 wt.% to less than 74 wt.% SiO_2 ;

0-5 wt.% B_2O_3 ;

0.1-2.5 wt.% Al_2O_3 ;

0.4 to less than 2 wt.% MgO ;

5-15 wt.% CaO ;

0-10 wt.% SrO ;

0-10 wt.% BaO wherein a total amount of MgO , CaO , SrO , and BaO is greater than 10 wt.% to 15 wt.%;

0-5 wt.% Li_2O ;

10-18 wt.% Na_2O ;

0-5 wt.% K_2O wherein a total amount of Li_2O , Na_2O and K_2O is 10-20 wt.%; and

0-0.40 wt.% TiO_2 ;

wherein a product of a mean linear expansion coefficient in a range of 50-350°C and Young's modulus is 0.71-0.90 MPa/°C, and a mean linear expansion coefficient in a range of 50-350°C is 80×10^{-7} - $110 \times 10^{-7}/^\circ\text{C}$.

2. A glass composition as claimed in claim 1, wherein the glass composition comprises:

65-70 wt.% SiO_2 ;

more than 0 wt.% and less than 2 wt.% B_2O_3 , and

MgO , CaO , SrO and BaO in a total amount of more than 10 wt.% and less than 12 wt.%.

3. A glass composition as claimed in claim 1, further comprising 0.4-1.9 wt.% of a total iron oxide ($\text{T-Fe}_2\text{O}_3$) expressed as Fe_2O_3 , the glass composition with a thickness from 1 to 6 mm having a solar

energy transmittance of not greater than 60% and ultraviolet transmittance of not greater than 30% defined by ISO.

4. A glass composition as claimed in claim 1, wherein the glass composition comprises 0.4-1 wt.% total iron oxide (T-Fe₂O₃) expressed as Fe₂O₃ and 0.01-0.40 wt.% TiO₂ and has a visible light transmittance of not smaller than 70% measured by the illuminant "A" with a thickness from 1 to 6 mm.

5. A glass composition as claimed in claim 1, wherein the glass composition comprises

0.4-0.65 wt.% total iron oxide (T-Fe₂O₃) expressed as Fe₂O₃ wherein a FeO ratio expressed as Fe₂O₃ against the total iron oxide (T-Fe₂O₃) is 20-60 wt.%;

more than 0.01 wt.% and less than 0.20 wt.% TiO₂; and

0.1-2.0 wt.% CeO₂, and

wherein the glass composition with a thickness from 3.5 to 5.0 mm has a visible light transmittance of not smaller than 70 %, a solar energy transmittance of not greater than 55% and an ultraviolet transmittance of not greater than 15% defined by ISO when measured by using the illuminant "A".

6. A glass composition as claimed in claim 1, wherein the glass composition comprises:

greater than 0.65 wt.% and less than 0.90 wt.% total iron oxide (T-Fe₂O₃) expressed as Fe₂O₃;

0.01-0.40 wt.% TiO₂; and

greater than 1.4 wt.% and less than 2.0 wt.% CeO₂,

a FeO ratio expressed as Fe₂O₃ against the total iron oxide (T-Fe₂O₃) is 20-60 wt.%, and

the glass composition with a thickness from 1.8 to 4.0 mm has a visible light transmittance of not smaller than 70 %, a solar

energy transmittance of not greater than 55% and an ultraviolet transmittance of not greater than 15% defined by ISO when measured by using the illuminant "A".

7. A glass composition as claimed in claim 1, wherein the glass composition further comprises:

- less than 0.005 wt.% CoO;
- less than 0.01 wt.% NiO; and
- less than 0.001 wt.% Se.

8. A glass composition as claimed in claim 1, wherein the glass composition further comprises:

- 0.9-1.9 wt.% T-Fe₂O₃;
- 0.005-0.05 wt.% CoO;
- 0-0.2 wt.% NiO; and
- 0-0.005 wt.% Se.

9. A glass composition as claimed in claim 8, wherein the glass composition with a thickness from 1.8 to 5.0 mm has a visible light transmittance of 10-65%, a solar energy transmittance of not greater than 50% and an ultraviolet transmittance of not greater than 15% defined by ISO when measured by using the illuminant "A".

10-11. (cancelled)

12. A glass composition as claimed in claim 1, wherein a density measured at a room temperature is greater than 2.47 g/cm³ and not greater than 2.65 g/cm³.

13-14. (cancelled)